

ND9000[®] INTELLIGENT VALVE CONTROLLER

Neles ND9000 is a top class intelligent valve controller designed to operate on every control valve actuator and in all industry areas. It guarantees the end product quality in all operating conditions with unique diagnostics and incomparable performance features. ND9000 is a reliable and future-proof investment with Metso FieldCare™ life-time support

KEY FEATURES

- Benchmark control performance on rotary and linear valves
- Reliable and robust design
- Easy commissioning and operation
- Language selection: English, German and French
- Local / remote operation
- Expandable architecture
- Advanced device diagnostics including
 - Self-diagnostics
 - Online diagnostics
 - Performance diagnostics
 - Communication diagnostics
 - Extended off-line tests
- Intelligent Valve Diamond

Options

- Interchangeable communication options:
 - HART
 - FOUNDATION fieldbus
 - Profibus PA
- Limit switches
- Position transmitter (in HART only)
- Full stainless steel enclosure
- Exhaust adapter

Total cost of ownership

- Low energy and air consumption
- Future proof design allows further options at a reduced cost
- Optimized spares program minimizes spare part inventory
- Retro-fit to existing installations (Neles or 3rd party valves)

Minimised process variability

- Linearisation of the valve flow characteristics
- Excellent dynamic and static control performance
- Fast response to control signal change
- Accurate internal measurements

Easy installation and configuration

- Same device can be used for linear and rotary valves, double and single-acting actuators
- Simple fast calibration and configuration
 - using Local User Interface (LUI)
 - using FieldCare software in a remote location
 - using Distributed Control System (DCS) asset management tools



- Extensive selection of mounting kits for 3rd party actuators
- Low power consumption enables installation to all common control systems

Open solution

- Metso is committed to delivering products that freely interface with software and hardware from a variety of manufacturers; ND9000 is no exception. This open architecture allows the ND9000 to be integrated with other field devices to give an unprecedented level of controllability.
- FDT and EDD based multi-vendor support configuration
- Support files for ND9000 are available from our internet page, at www.metso.com/valves - choose link download center



Neles ND9000 in fieldbus networks

- Approved interoperability
 - Host interoperability ensured
 - FOUNDATION fieldbus ITK version 5.01 certified
 - Profibus PA profile version 3.0 PNO certified
- Easy to upgrade; can be done by replacing the HART communication board to fieldbus communication board
- Excellent maintainability with firmware download feature
- Advanced communication diagnostics
- Digital communication via the fieldbus includes not only the set point, but also the position feedback signal from the position sensor. No special supplementary modules for analog or digital position feedback are needed when using the fieldbus valve controller.
- Back up LAS functionality available in FOUNDATION fieldbus environment
- Input selector and output splitter blocks available in FOUNDATION fieldbus devices allowing advanced distributed control
- Standard function blocks enables the freedom to use ND9000 intelligent valve controller either in continuous or on-off control applications
- Open and close information is directly available via the fieldbus
- Open and close detection is based on either position measurement (soft limit switch) or mechanical limit switch information

ND9000 mounting on actuators and valves

- Mounted on single and double acting actuators
- Both rotary and linear valves
- Ability to attach options to electronics and mechanics later
- 1-point calibration feature enables mounting without disturbing the process

Product reliability

- Designed to operate in harsh environmental conditions
- Rugged modular design
- Excellent temperature characteristics
- Vibration and impact tolerant
- IP66 enclosure
- Stainless steel enclosure (ND9300)
- Protected against humidity
- Maintenance free operation
- Resistant to dirty air
- Wear resistant and sealed components
- Contactless position measurement

Predictive maintenance

- Easy access to collected data with Metso FieldCare software
- Intelligent Valve Diamond to visualise control valve performance & diagnostics
- Logical trend and histogram collection
- Information collected during process uptime
- Extensive set of off-line tests with accurate key figure calculations
- Fast notifications with on-line alarms
- Condition monitoring tool available

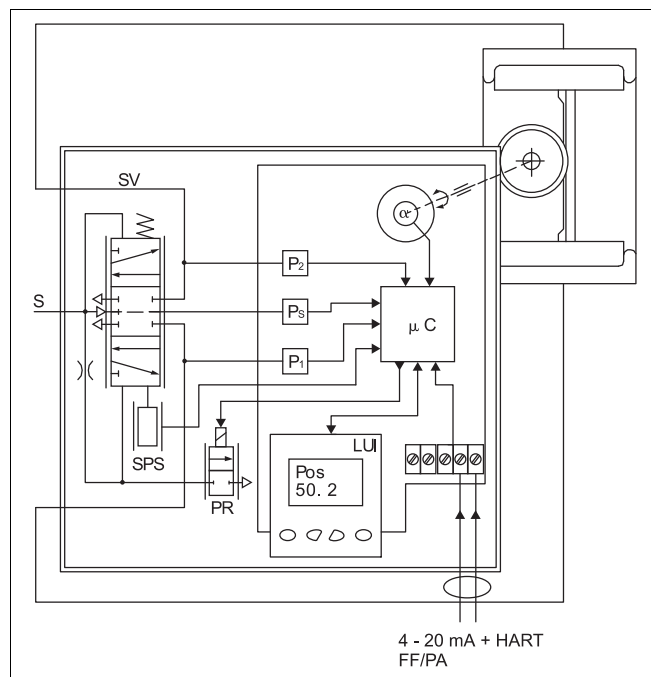
TECHNICAL DESCRIPTION

The ND9000 is a 4–20 mA or fieldbus powered microcontroller-based intelligent valve controller. The device contains a Local User Interface (LUI) enabling local configuration. A PC with FieldCare software can be connected to the ND9000 itself or to the control loop.

The powerful 32-bit microcontroller controls the valve position. The measurements include:

- Input signal
- Valve position with contactless sensor
- Actuator pressures, 2 independent measurements
- Supply pressure
- Spool valve position
- Device temperature

Advanced self-diagnostics guarantees that all measurements operate correctly. After connections of electric signal and pneumatic supply the micro controller (μC) reads the input signal, position sensor (α), pressure sensors (P_s , P_1 , P_2) and spool position sensor (SPS). A difference between input signal and position sensor (α) measurement is detected by control algorithm inside the μC . The μC calculates a new value for prestage (PR) coil current based on the information from the input signal and from the sensors. Changed current to the PR changes the pilot pressure to the spool valve. Reduced pilot pressure moves the spool and the actuator pressures change accordingly. The spool opens the flow to the driving side of the double diaphragm actuator and opens the flow out from the other side of the actuator. The increasing pressure will move the diaphragm piston. The actuator and feedback shaft rotate. The position sensor (α) measures the rotation for the μC . The μC using control algorithm modulates the PR-current from the steady state value until a new position of the actuator according to the input signal is reached.



TECHNICAL SPECIFICATIONS

ND9000 INTELLIGENT VALVE CONTROLLER

General

Loop powered, no external power supply required.
 Suitable for rotary and linear valves.
 Actuator connections in accordance with VDI/VDE 3845 and IEC 60534-6 standards.
 Flush mounting on selected actuators
 Action: Double or single acting
 Travel range: Linear; 10–120 mm / 0.4–4.7 in
 rotary; 45–95 degrees. Measurement range 110° with freely rotating feedback shaft.

Environmental influence

Standard temperature range:
 -40° – +85 °C / -40° – +185 °F
 Influence of temperature on valve position:
 0.5 % /10 °K
 Influence of vibration on valve position:
 < 1 % under 2g 5–150 Hz,
 1g 150–300 Hz, 0.5g 300–2000 Hz

Enclosure

Material: ND9100: Anodized aluminium alloy and polymer composite
 ND9200: Anodised aluminium alloy and tempered glass
 ND9300: Full 316 stainless steel
 Protection class: IP66, Nema 4x
 Pneumatic ports: G 1/4 (ND9100)
 1/4 NPT (ND9200 and ND9300)
 Cable gland thread: M20x1.5 (ND9000)
 1/2 NPT ((ND9000E2, ND9000U1 and ND9000U2)
 Weight: 1.8 kg / 4.0 lbs (ND9100)
 3.4 kg / 7.5 lbs (ND9200)
 8.6 kg / 19.0 lbs (ND9300)
 Mechanical and digital position indicator visible through main cover, not applicable ND9200E2 and ND9300.
 Special corrosion resistance design or stainless steel housing available as an option for demanding environment.

Pneumatics

Supply pressure: 1.4–8 bar / 20–115 psi
 Effect of supply pressure on valve position:
 < 0.1 % at 10 % difference in inlet pressure
 Air quality: Acc. to ISO 8573-1
 Solid particles: Class 5 (3 – 5 µm filtration is recommended)
 Humidity: Class 1 (dew point 10 °C/ 18 °F below minimum temperature is recommended)
 Oil class: 3 (or < 1 ppm)
 Capacity with 4 bar / 60 psi supply:
 5.5 Nm³/h / 3.3 scfm (spool valve 2)
 12 Nm³/h / 7.1 scfm (spool valve 3)
 38 Nm³ /h /22,4 scfm (spool valve 6)
 Consumption with 4 bar / 60 psi supply in steady state position:
 < 0.6 Nm³/h /0.35 scfm (spool valve 2 & 3)
 < 1.0 Nm³/h / 0.6 scfm (spool valve 6)

Electronics

HART

Supply power: Loop powered, 4–20 mA
 Minimum signal: 3.6 mA
 Current max : 120 mA
 Load voltage: up to 9.7 VDC/20 mA (corresponding 485 Ω)
 Voltage: max. 30 VDC
 Polarity protection: -30 VDC
 Over current protection: active over 35 mA

Profibus PA and FOUNDATION fieldbus

Supply power: voltage 9–32 VDC, reverse polarity protection
 Max basic current 17.2 mA
 Fault current (FDE) 3.9 mA

FOUNDATION fieldbus function block execution times

| | |
|-----|-------|
| AO | 20 ms |
| PID | 25 ms |
| DO | 15 ms |
| DI | 15 ms |
| IS | 15 ms |
| OS | 20 ms |

Performance with moderate constant-load actuators EC05-EC10 in ambient temperature

Dead band acc. to IEC 61514: ≤ 0.1 %
 Hysteresis acc. to IEC 61514: < 0.5 %

Local User Interface (LUI) functions

- Local control of the valve
- Monitoring of valve position, target position, input signal, temperature, supply and actuator pressure difference
- Guided-startup function
- LUI may be locked remotely to prevent unauthorised access
- Calibration: Automatic / Manual linearization
- 1-point calibration
- Control configuration: aggressive, fast, optimum, stable, maximum stability
- Configuration of the control valve
 - Rotation: valve rotation clockwise or counter-clockwise to close
 - Dead Angle
 - Low cut-off, cut-off safety range (default 2 %)
 - Positioner fail action, open/close
 - Signal direction: Direct/reverse acting
 - Actuator type, double/single acting
 - Valve type, rotary/linear
 - Language selection: English, German and French

Position transmitter (optional)

Output signal: 4–20 mA (galvanic isolation; 600 VDC)
 Supply voltage: 12–30 VDC
 Resolution: 16 bit / 0.244 µA
 Linearity: < 0.05 % FS
 Temperature effect: < 0.35 % FS
 External load: max 0–780 Ω
 max 0–690 Ω for intrinsically safe
 Ex ia IIC T6 Ui ≤ 28 V
 Ex d IIC T4/T5/T6 Ui ≤ 30 V

Approvals

**ND9100H, ND9100F, ND9100P
ND9300H, ND9300F and ND9300P**

Intrinsically safe, non incendive and dust exclusion

IECEX IEC 60079-0: 2007-10, IEC 60079-11: 2006, IEC 60079-26: 2006, IEC 60079-27: 2005-04, IEC 61241-0: 2004, IEC 61241-1: 2004
Ex ia IIC T4/T5/T6 Ga
Ex tD A20 IP66 T90 °C
or
Ex ia IIC T4/T5/T6 Gb
Ex tD A21 IP66 T90 °C
IEC 60079-0: 2007-10, IEC 60079-15: 2005-03, IEC 60079-27: 2005-04, IEC 61241-0: 2004, IEC 61241-1: 2004
Ex nA IIC T4/T5/T6 Gc
Ex tD A22 IP66 T90 °C
or
Ex nL IIC T4/T5/T6 Gc
Ex tD A22 IP66 T90 °C
Certificates IECEX VTT 10.0004X and IECEX VTT 10.0005X

ATEX EN 60079-0: 2007/2009, EN 60079-11: 2007, EN 60079-26: 2007, EN 60079-27: 2006, EN 61241-0: 2006, EN 61241-1: 2004
II 1G Ex ia IIC T4/T5/T6 Ga
II 1D Ex tD A20 IP66 T90 °C
or
II 2 G Ex ia IIC T4/T5/T6 Gb
II 2 D Ex tD A21 IP66 T90 °C
EN 60079-0: 2007/2009, EN 60079-15: 2005, EN 60079-27: 2006, EN 61241-0: 2006
EN 61241-1: 2004
II 3 G Ex nA IIC T4/T5/T6 Gc
II 3 D Ex tD A22 IP66 T90 °C
or
II 3 G Ex nL IIC T4/T5/T6 Gc
II 3 D Ex tD A22 IP66 T90 °C
Certificates VTT 09 ATEX 033X and VTT 09 ATEX 034X

CSA CAN/CSA-C22.2-0,-142, -157; CAN/CSA-E60079-0,-11, -15
IS Class I, Div. 1, Groups A, B, C, D T4/T5/T6
IS Class I, Zone 0, Ex ia IIC T4/T5/T6

FM NI Class I, Div. 2, Groups A, B, C, D T4/T5/T6
FM Class 3600, 3610, 3611, 3810, ANSI/ISA-60079-0, 60079-11:
IS Class I, Div. 1, Groups A, B, C, D T4/T5/T6
IS Class I, Zone 0, AEx ia IIC T4/T5/T6
NI Class I, Div. 2, Groups A, B, C, D T4/T5/T6

INMETRO IEC 60079-0, IEC 60079-11, IEC 60529 BR-Ex ia IIC T4/T5/T6 IP66
or
IEC 60079-0, IEC 60079-15, IEC 60529 BR-Ex nA II / nL IIC T4/T5/T6 IP66

**ND9200H, ND9200F, ND9200P
ND9300H, ND9300F and ND9300P**
Flameproof, explosion proof and dust exclusion

ATEX EN 60079-0: 2006, EN 60079-1: 2004
EN 61241-0: 2006, EN 61241-1: 2004
II 2 G Ex d IIC T4/T5/T6
II 2 D Ex tD A21 IP66 T100 °C
Certificate KEMA 04ATEX2098 X

IECEX IEC 60079-0: 2004, IEC 60079-1: 2003
Ex d IIC T4/T5/T6
IEC 61241-0 : 2004 and IEC 61241-1: 2004
Ex tD A21 IP66 T100 °C
Certificate IECEX KEM 10.0055X

INMETRO IEC 60079-0, IEC 60079-1, IEC 60529 BR-Ex d IIC, T4/T5/T6, IP66

ND9200H, ND9200F and ND9200P
Flameproof, explosion proof and dust exclusion

CSA Explosion proof Class I, II and III, Division 1 and 2, Groups B, C, D, E, F

FM Explosion proof Class I, II and III, Division 1 and 2, Groups A, B, C, D, E, F

TIIS (JIS) Ex d II C T6 (**ND9200H only**)

Electromagnetic Protection

Electromagnetic compatibility
Emission acc. to EN 61000-6-4 (2007) and FCC 47 CFR PART 15, SUBPART B, CLASS B (1994)
Immunity acc. to EN 61000-6-2 (2005)

PROXIMITY SENSORS AND LIMIT SWITCHES (OPTIONAL WITH EXTENSION MODULE FOR ND9100, ND9200 & ND9300)

Code I02 P+F NJ2-12GK-SN, 2 sensors
Code I09 P+F; NCB2-12GM35-N0
Code I32 Omron E2E-X2Y1, micro switch, 2 sensors
Code I45 P+F NJ3-13GK-S1N, 2 sensors
Code I56 IFC 2002-ARKG/UP, 2 sensors
Code K05 Omron D2VW-5, micro switch, 2 sensors
Code K06 Omron D2VW-01 gold plated, micro switch
Code B06 Omron D2VW-01 gold plated, micro switch, 2 sensors. (Bus powered, no external power and cabling needed).

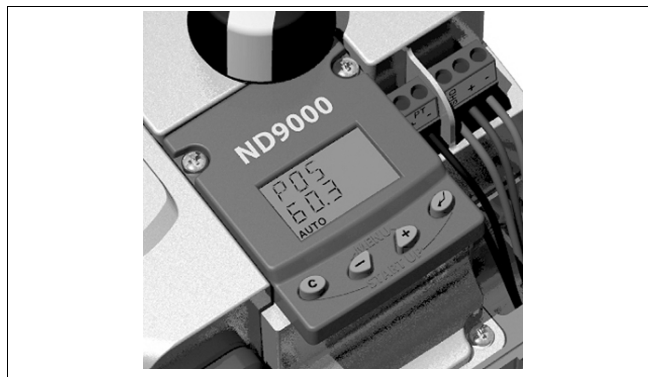


Fig. 1. Local User Interface (LUI) enables real time awareness of control parameters in the device at a glance.

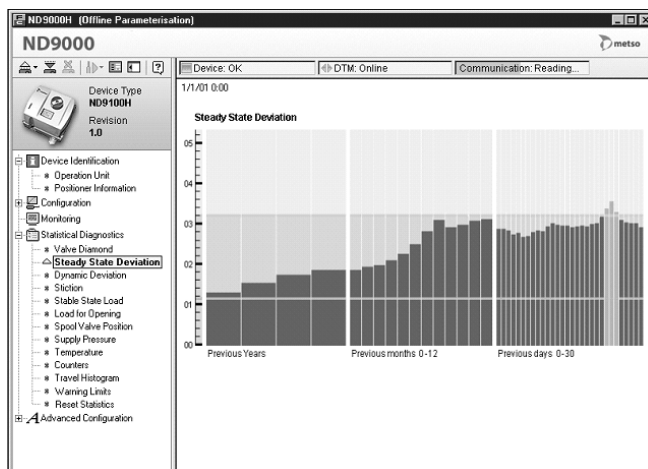
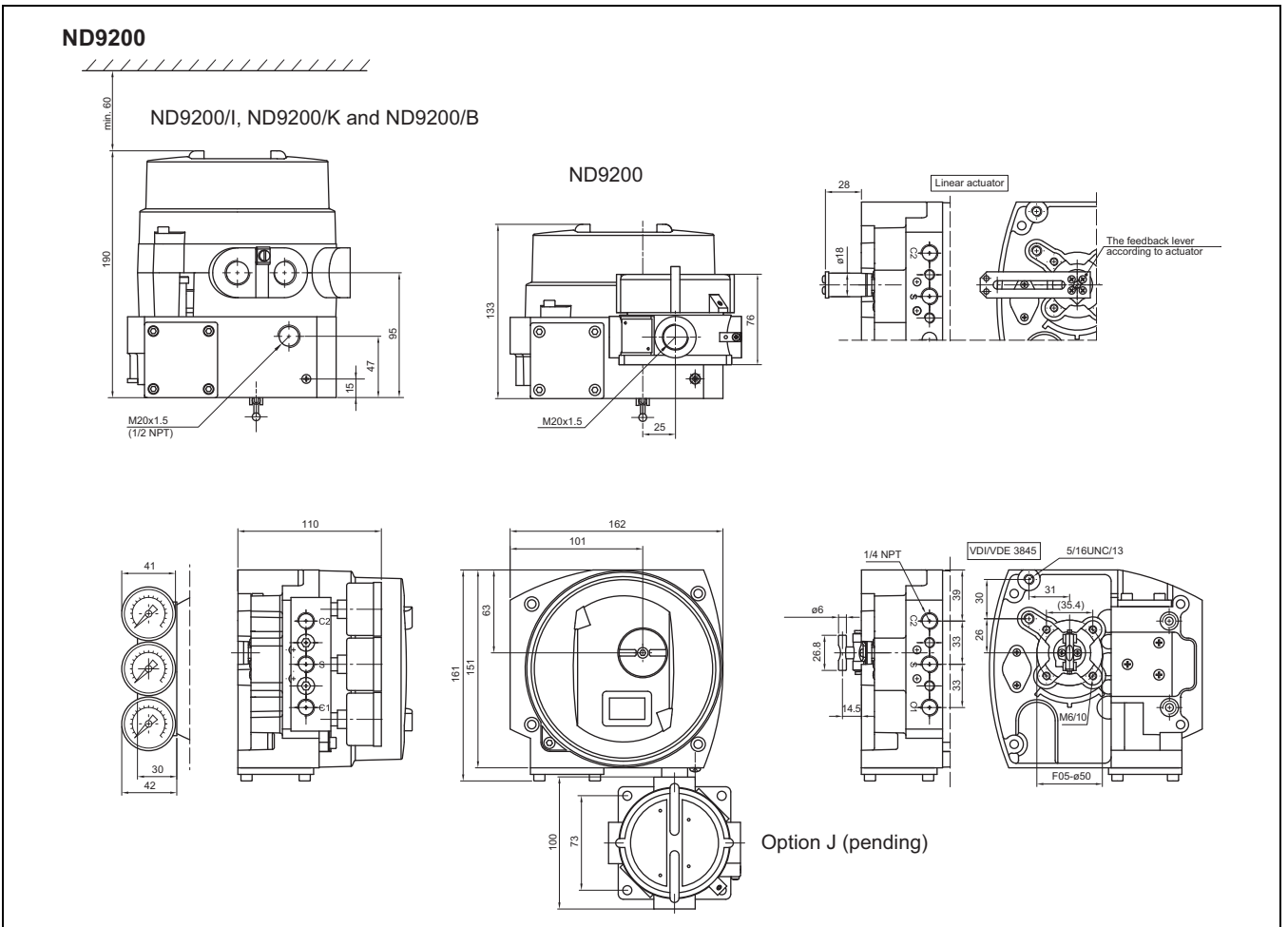
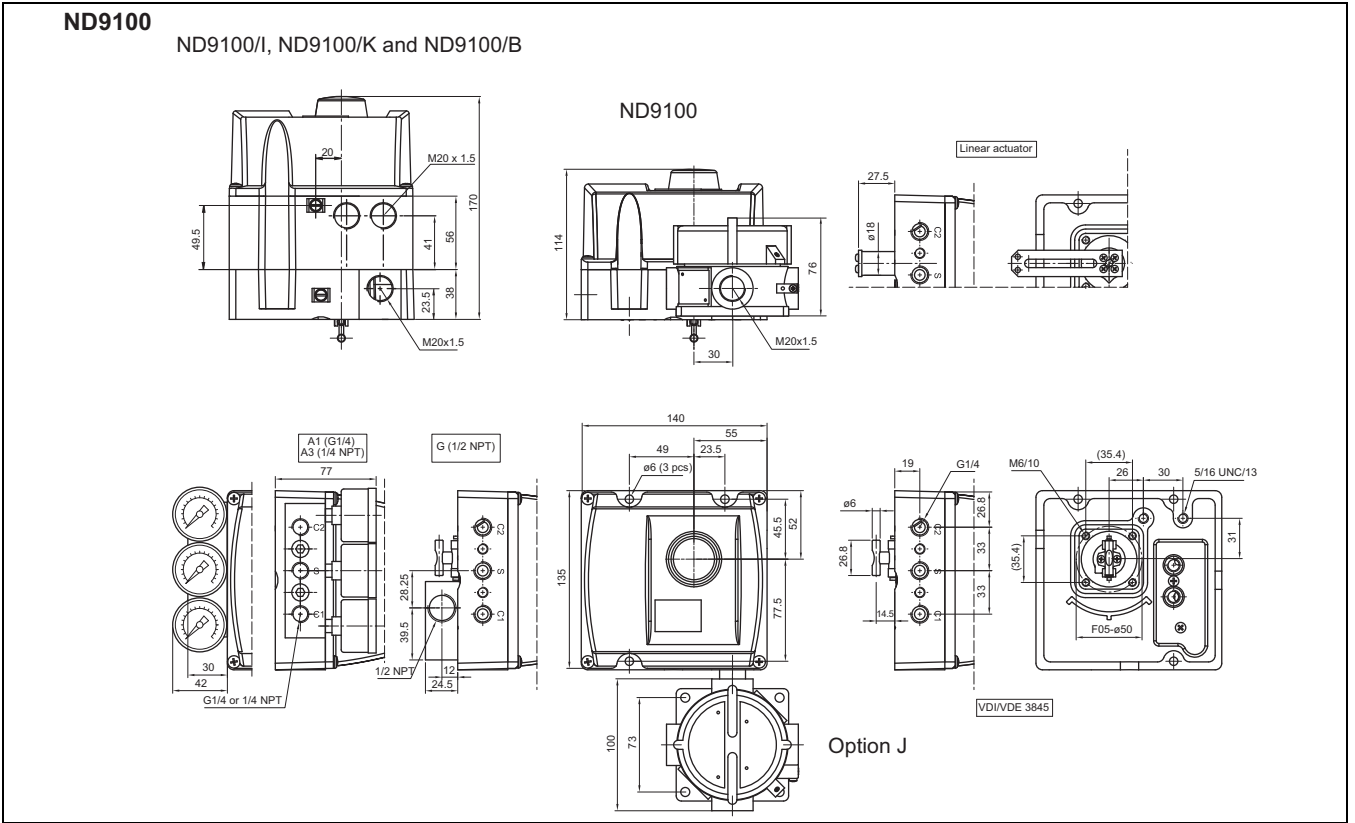
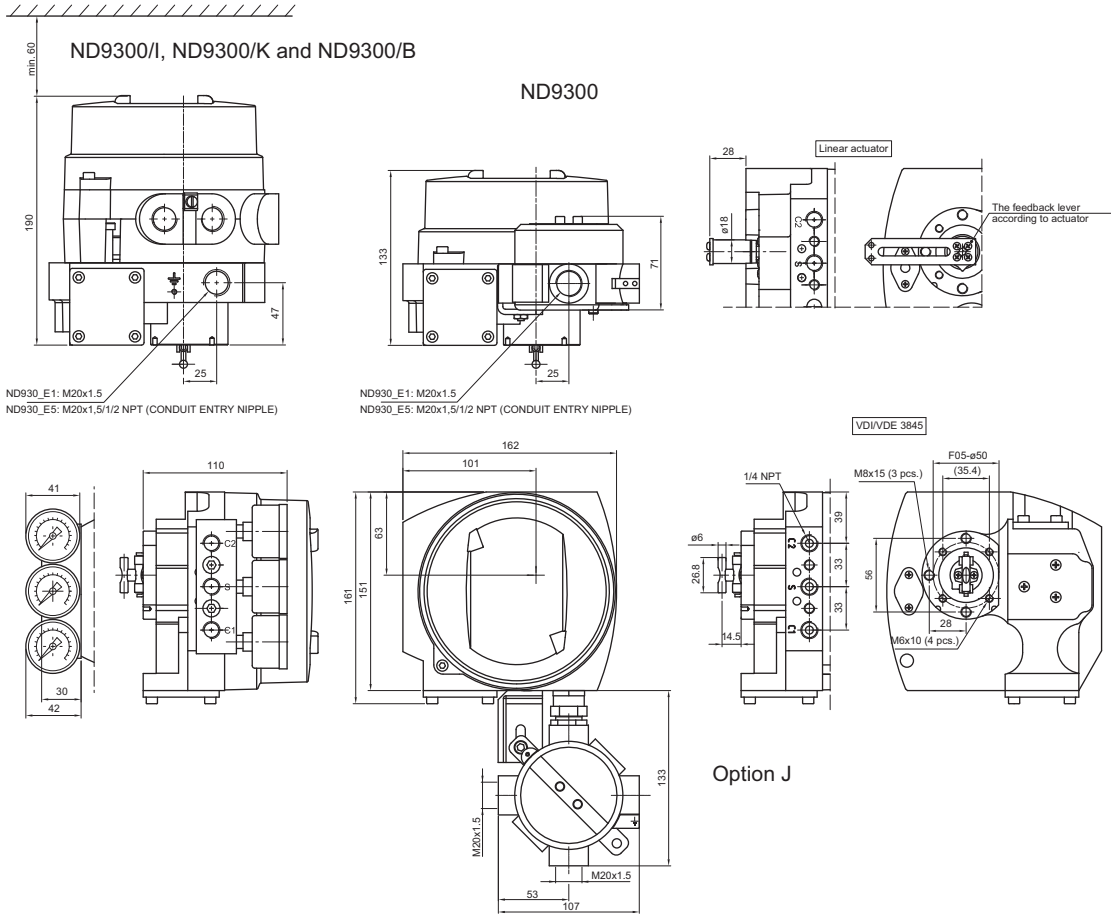


Fig. 2. Trend collection enables fast and easy predictive maintenance. The need for maintenance is reduced and increased plant and process availability are realised.

DIMENSIONS



ND9300



HOW TO ORDER

**INTELLIGENT VALVE CONTROLLER ND9000 /
LIMIT SWITCH (ND9000/I___, ND9000/K0_ or ND9000/B06)**

| | | | | | | | | | |
|----|----|----|----|----|----|----|----|-----|----|
| 1. | 2. | 3. | 4. | 5. | 6. | 7. | *) | 8. | 9. |
| ND | 9 | 20 | 3 | H | E1 | T | / | K05 | |

| 1. | PRODUCT GROUP | |
|----|--|--|
| ND | Intelligent Valve Controller. | |
| 2. | SERIES CODE | |
| 9 | Series 9000 valve controller with universal shaft and attachment face according to standard VDI/VDE 3845 and Metso standard. Relevant shaft adapter included in mounting kits. When valve controllers are separate deliveries, shaft adapter kit | |
| 3. | ENCLOSURE | |
| 10 | Standard IP66 / NEMA 4X enclosure. | |
| 20 | Flameproof (Ex d) IP66 / NEMA 4X enclosure. | |
| 30 | Stainless steel flameproof (Ex d) IP66 / NEMA 4X enclosure. | |
| 4. | SPOOL VALVE | PNEUMATIC CONNECTIONS (S, C1, C2) |
| 2 | Low capacity. Stroke volume of actuator < 1 dm ³ . | G 1/4 (ND9100 series), 1/4 NPT (ND9200/ND9300 series). |
| 3 | Medium capacity. Stroke volume of actuator 1–3 dm ³ . | G 1/4 (ND9100 series), 1/4 NPT (ND9200/ND9300 series). |
| 6 | High capacity. Stroke volume of actuator > 3 dm ³ . | G 1/4 (ND9100 series), 1/4 NPT (ND9200/ND9300 series). |
| 5. | COMMUNICATION / INPUT SIGNAL RANGE | |
| H | 4–20 mA, HART communication. Supply voltage 30 V DC. Load voltage: up to 9.7 V DC at 20 mA corresponding to 485 Ω (maximum voltage drop). | |
| F | FOUNDATION fieldbus, physical layer according to IEC 61158-2. | |
| P | Profibus PA, physical layer according to IEC 61158-2. | |
| 6. | APPROVALS OF STANDARD ENCLOSURE VALVE CONTROLLER | |
| N | No approvals for hazardous areas. M20 x 1.5 conduit entry. Temperature range -40° to +85 °C / -40° to +185 °F. Not applicable to 3. sign "20". | |
| X | ATEX and IECEx certifications: II 1 G Ex ia IIC T4/T5/T6 Ga II 1 D Ex tD A20 IP66 T90 °C II 2 G Ex ia IIC T4/T5/T6 Gb II 2 D Ex tD A21 IP66 T90 °C ND91_HX and ND93_HX: Ui ≤ 28 V, li ≤ 120 mA, Pi ≤ 1 W, Ci ≤ 22 nF, Li ≤ 53 μH. ND91_FX, ND91_PX, ND93_FX and ND93_PX: FISCO model Ui ≤ 24 V, li ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 μH. Temperature range: T4: -40° to +80 °C / -40° to +176 °F; T5: < +65 °C / < +149 °F; T6: < +50 °C / < +122 °F. II 3 G Ex nA IIC T4/T5/T6 Gc II 3 D Ex tD A22 IP66 T90 °C ND91_HX and ND93_HX: Ui ≤ 30 V, li ≤ 152 mA, ND91_FX and ND91_PX, ND93_FX and ND93_PX: Ui ≤ 24 V Temperature range: T4: -40° to +85 °C / -40° to +185 °F; T5: < +75 °C / +167 °F; T6: < +60 °C / +140 °F. II 3 G Ex nL IIC T4/T5/T6 Gc II 3 D Ex tD A22 IP66 T90 °C ND91_HX and ND93_HX: Ui ≤ 30 V, li ≤ 152 mA, Pmax = device limits itself, Ci ≤ 22 nF, Li ≤ 53 μH. ND91_FX and ND91_PX, ND93_FX and ND93_PX: FNICO model Ui ≤ 32 V, li ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 μH. Temperature range: T4: -40° to +85 °C / -40° to +185 °F; T5: < +75 °C / +167 °F; T6: < +60 °C / +140 °F. Not applicable to 3. sign "20". Available without limit switches or with ATEX or IECEx certified inductive limit switches. Ex tD certification is not available with 7. sign "M". M20 x 1.5 conduit entry. With limit switch Temperature range marking is updated according switch type. | |

| 6. | APPROVALS OF STANDARD ENCLOSURE VALVE CONTROLLER |
|----|---|
| U1 | FM and CSA certifications: IS Class I, Division 1, Groups A, B, C, D, T4/T5/T6 IS Class I, Zone 0, AEx ia, IIC T4/T5/T6 Temperature range: T4: -40° to +80 °C / -40° to +176 °F; T5: < +65 °C / +149 °F; T6: < +50 °C / +122 °F. Not applicable to 3. sign "20". Not available with any limit switches (8. sign "I", "K" or "B"). 1/2 NPT conduit entry. ND91_HU1 and ND93_HU1: Ui ≤ 28 V, li ≤ 120 mA, Pi ≤ 1 W, Ci ≤ 22 nF, Li ≤ 53 μH. ND91_FU1, ND91_PU1, ND93_FU1 and ND93_PU1: Ui ≤ 24 V, li ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 μH. |
| U2 | FM and CSA certifications: NI Class I, Division 2, Groups A, B, C, D, T4/T5/T6. NI Class I, Zone 2, Ex nA IIC T4/T5/T6. Temperature range: T4: -40° to +85 °C / -40° to +185 °F; T5: < +70 °C / +158 °F; T6: < +55 °C / +131 °F. No Zener Barrier needed. Not applicable to 3. sign "20". Not available with any limit switches (8. sign "I", "K" or "B"). 1/2 NPT conduit entry. ND91_HU2 and ND93_HU2: Ui ≤ 30 V, Pmax = device limits itself, Ci ≤ 22 nF, Li ≤ 53 μH. ND91_FU2, ND91_PU2, ND93_FU2 and ND93_PU2: Ui ≤ 24 V, li ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 μH. |
| Z1 | INMETRO certifications: BR-Ex ia IIC T4/T5/T6 IP66 Temperature range: T4: -40° to +80 °C / -40° to +176 °F; T5: < +65 °C / < +149 °F; T6: < +50 °C / < +122 °F. Approved for Zone 0. Not applicable to 3. sign "20". Not available with the limit switches (8. sign "I", "K" or "B"). M20 x 1.5 conduit entry. ND91_HZ1, ND93_HZ1: Ui ≤ 28 V, li ≤ 120 mA, Pi ≤ 1 W, Ci ≤ 22 nF, Li ≤ 53 μH. ND91_FZ1, ND91_PZ1, ND93_FZ1 and ND93_PZ1: Ui ≤ 24 V, li ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 μH. |
| Z2 | INMETRO certifications: BR-Ex ia IIC T4/T5/T6 IP66 Temperature range: T4: -40° to +80 °C / -40° to +176 °F; T5: < +65 °C / < +149 °F; T6: < +50 °C / < +122 °F. Approved for Zone 1. Not applicable to 3. sign "20". Only available with ATEX certified inductive limit switches (e.g. I02, I09) and B switches. Without limit switches, use Z1 instead. M20 x 1.5 conduit entry. ND91_HZ2, ND93_HZ2: Ui ≤ 28 V, li ≤ 120 mA, Pi ≤ 1 W, Ci ≤ 22 nF, Li ≤ 53 μH. ND91_FZ2, ND91_PZ2, ND93_FZ2 and ND93_PZ2: Ui ≤ 24 V, li ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 μH. |
| Z3 | INMETRO certifications: BR-Ex nA II / nL IIC T4/T5/T6 IP66 Temperature range: T4: -40° to +85 °C / -40° to +185 °F; T5: < +75 °C / +167 °F; T6: < +60 °C / +140 °F. Not applicable to 3. sign "20". M20 x 1.5 conduit entry. ND91_HZ3 and ND93_HZ3: Ui ≤ 30 V, Pmax = device limits itself, Ci ≤ 22 nF, Li ≤ 53 μH. ND91_FZ3, ND91_PZ3, ND93_FZ3 and ND93_PZ3: Ui ≤ 24 V, Ci ≤ 5 nF, Li ≤ 10 μH. |
| E1 | ATEX and IECEx certifications: II 2 G Ex d IIC T4/T5/T6 II 2 D Ex tD A21 IP66 T100 °C Temperature range: T4: -40° to +85 °C / -40° to +185 °F; T5: < +75 °C / < +167 °F; T6: < +60 °C / < +140 °F. Not applicable to 3. sign "10". M20 x 1.5 conduit entry. ND92_HE1, ND93_HE1: Ui ≤ 30 V. ND92_FE1, ND92_PE1, ND93_FE1 and ND93_PE1: Ui ≤ 32 V. |

| 6. APPROVALS OF STANDARD ENCLOSURE VALVE CONTROLLER | |
|---|--|
| E2 | <p>FM certification: Class I, Div 1, Groups A, B, C, D, Class II, Div 1, Groups E, F, G, Class III T4/T5/T6 Class I, Zone 1, AEx d IIC, T4/T5/T6, IP66 / Type 4X</p> <p>CSA certification: Class I, Div 1, Groups B, C, D, Class II, Div 1, Groups E, F, G, Class III T4/T5/T6 Ex d IIC T4/T5/T6, DIP A21, Ta 100°C, IP66 / NEMA 4X Temperature range: T4: -40° to +85 °C / -40° to +185 °F; T5: < +75 °C / < +167 °F; T6: < +60 °C / < +140 °F. Applicable to 3. sign "20" only. 1/2 NPT conduit entry.</p> <p>ND92_HE2: Ui ≤ 30 V.</p> <p>ND92_FE2 and ND92_PE2: Ui ≤ 32 V.</p> |
| E4 | <p>TIIS (JIS) certifications: Ex d II C T6 Temperature range: T6: -20° to +60 °C / -4° to +140 °F. Applicable only to 3. sign "20". Applicable only to 5. sign "H". Not available with option "M" (7. sign). Not available with any limit switches (8. sign "I" or "K"). G 1/2 or 1/2 NPT conduit entry. Delivered always with TIIS (JIS) approved cable gland and conduit entry nipple (accessory CG42 or CG41), see type code from Accessories for Positioners item 10: CG42: G 1/2 Conduit entry and Cable entry adapter. CG41: 1/2 NPT Conduit entry and Cable entry adapter.</p> <p>ND92_HE4: Ui ≤ 30 V.</p> |
| E5 | <p>INMETRO certification: BR-Ex d IIC, T4/T5/T6, IP66 Temperature range: T4: -40° to +85 °C / -40° to +185 °F; T5: < +75 °C / < +167 °F; T6: < +60 °C / < +140 °F. Not applicable to 3. sign "10". M20 x 1.5 conduit entry.</p> <p>ND92_HE5, ND93_HE5: Ui ≤ 30 V.</p> <p>ND92_FE5, ND92_PE5, ND93_FE5, ND93_PE5: Ui ≤ 32 V.</p> |
| 7. OPTIONS OF VALVE CONTROLLER | |
| T | <p>ND9_H_T only: Internal 2-wire (passive) position transmitter. Analog position feedback signal, output 4–20 mA, supply voltage 12–30 V DC, external load resistance 0–780 Ω.</p> <p>ND91_HXT, ND93_HXT: II 1 G Ex ia IIC T4/T5/T6 Ga II 1 D Ex tD A20 IP66 T90 °C II 2 G Ex ia IIC T4/T5/T6 Gb II 2 D Ex tD A21 IP66 T90 °C Ui ≤ 28 V, li ≤ 120 mA, Pi ≤ 1 W, Ci ≤ 22 nF, Li ≤ 53 µH, external load resistance 0–690 Ω .</p> <p>ND91_HXT, ND93_HXT: II 3 G Ex nA IIC T4/T5/T6 Gc II 3 D Ex tD A22 IP66 T90 °C Ui ≤ 30 V, li ≤ 152 mA II 3 G Ex nL IIC T4/T5/T6 Gc II 3 D Ex tD A22 IP66 T90 °C Ui ≤ 30 V, li ≤ 152 mA, Pmax = device limits itself, Ci ≤ 22 nF, Li ≤ 53 µH, external load resistance 0–780 Ω .</p> <p>ND91_HU1T and ND93_HU1T: Ui ≤ 28 V, li ≤ 120 mA, Pi ≤ 1 W, Ci ≤ 22 nF, Li ≤ 53 µH, external load resistance 0–690 Ω . ND91_HU2T and ND93_HU2T: Ui ≤ 30 V, Pmax = device limits itself, Ci ≤ 22 nF, Li ≤ 53 µH, external load resistance 0–780 Ω . ND92_HE1T, ND92_HE2T, ND92_HE4T, ND92_HE5T, ND93_HE1T, ND93_HE5T: Ui ≤ 30 V, Pmax = device limits itself, external load resistance 0–780 Ω .</p> |
| J | <p>Applicable to 6. sign "N" and "X". ND91_H and ND93_H: External junction box for all 4–20 mA wirings, including position transmitter, if applicable. Junction box is connected to the enclosure, 2 pcs. M20 x 1.5 conduit entry.</p> <p>ND91_F, ND93_F, ND91_P and ND93_P: External junction box for wirings, including option for parallel connection of external surge protector. Junction box is connected to the enclosure, 2 pcs. M20 x 1.5 conduit entry.</p> |
| M | <p>Special corrosion resistant finish. External aluminium surfaces protected by hard anodizing with PTFE. Coating thickness 20 µm. Not painted. Not applicable to 3. sign "30". Not available with 6. sign "E4". Not available with 7. sign "G". Not available with ATEX and IECEx Ex tD certification.</p> |
| G | <p>Exhaust adapter. ND9100: 1x 1/2 NPT thread, ND9200 and ND9300: 2 x 1/2 NPT thread. Not available with 7. sign "M".</p> |
| Y | <p>Special construction.</p> |

| 8. LIMIT SWITCH TYPE | |
|--|--|
| <p>Inductive proximity switches, 2 pcs. IP66 / NEMA 4X enclosure. M20 x 1.5 conduit entry (2 pcs.). Option E2: 1/2 NPT conduit entry (2 pcs.).</p> | |
| 102 | <p>P+F NJ2-12GK-SN, 2-wire type, DC; > 3 mA; < 1 mA. Temperature range: -40° to +85 °C / -40° to +185 °F. Intrinsically safe according to ATEX and IECEx.</p> <p>1 G Ex ia IIC T6 Ui ≤ 16 V, li ≤ 25 mA, Pi ≤ 64 mW, Li ≤ 150 µH, Ci ≤ 50 nF. Temperature range: T4: -40° to +80 °C / -40° to +176 °F; T5: < +64 °C / < +147 °F; T6: < +50 °C / < +122 °F.</p> <p>II 2 G Ex ia IIC T6 Ui ≤ 16 V, li ≤ 52 mA, Pi ≤ 169 mW, Li ≤ 150 µH, Ci ≤ 50 nF. Temperature range: T4: -40° to +80 °C / -40° to +176 °F; T5: < +64 °C / < +147 °F; T6: < +50 °C / < +122 °F. Not applicable to 6. sign "Z1", "U1", "U2" and "E4".</p> |
| 109 | <p>P+F; NCB2-12GM35-N0, 2-wire type, DC; > 3 mA; < 1 mA Temperature range: -25° to +85 °C / -13° to +185 °F. Intrinsically safe according to ATEX and IECEx II 1 G Ex ia IIC T6 Ui ≤ 16 V, li ≤ 25 mA, Pi ≤ 64 mW, Li = 100 µH, Ci = 90 nF Temperature range: T4: -25° to +80 °C / -13° to +176 °F; T5: < +65 °C / < +147 °F; T6: < +50 °C / < +122 °F.</p> <p>II 2 G Ex ia IIC T6 Ui ≤ 16 V, li ≤ 52 mA, Pi ≤ 169 mW, Li = 100 µH, Ci = 90 nF Temperature range: T4: -25° to +80 °C / -13° to +176 °F; T5: < +65 °C / < +147 °F; T6: < +50 °C / < +122 °F.</p> <p>II 3 G Ex nL IIC T6 Ui ≤ 20 V, li ≤ 25 mA, Pi ≤ 64 mW, Li = 100 µH, Ci = 90 nF Temperature range: T4: -25° to +55 °C / -13° to +131 °F; T5: < +55 °C / < +131 °F; T6: < +55 °C / < +131 °F.</p> <p>Not applicable to 6. sign "Z1", "U1", "U2" and "E4".</p> |
| 132 | <p>Omron E2E-X2Y1, 2-wire type; AC; <100 mA; 24–240 V AC. Temperature range: -40° to +85 °C / -40° to +185 °F. Applicable to 6. sign "N" and "E1".</p> |
| 145 | <p>P+F NJ3-18GK-S1N, 2-wire type, DC; > 3 mA; < 1 mA, NAMUR NO. Temperature range: -25° to +85 °C / -13° to +185 °F. Intrinsically safe according to ATEX and IECEx.</p> <p>II 1 G Ex ia IIC T6 Ui ≤ 16 V, li ≤ 25 mA, Pi ≤ 64 mW, Li ≤ 200 µH, Ci ≤ 70 nF. Temperature range: T4: -25° to +80 °C / -13° to +176 °F; T5: < +64 °C / < +147 °F; T6: < +50 °C / < +122 °F.</p> <p>II 2 G Ex ia IIC T6 Ui ≤ 16 V, li ≤ 52 mA, Pi ≤ 169 mW, Li ≤ 200 µH, Ci ≤ 70 nF. Temperature range: T4: -25° to +80 °C / -13° to +176 °F; T5: < +64 °C / < +147 °F; T6: < +50 °C / < +122 °F.</p> <p>II 3 G Ex nL IIC T6 Ui ≤ 16 V, li ≤ 25 mA, Pi ≤ 64 mW, Li ≤ 200 µH, Ci ≤ 70 nF. Temperature range: T4: -25° to +85 °C / -13° to +185 °F; T5: < +75 °C / < +167 °F; T6: < +60 °C / < +140 °F. Not applicable to 6. sign "Z1", "U1", "U2" and "E4".</p> |
| 156 | <p>ifm IFC2002-ARKG/UP, 2-wire type, DC; 150 mA, 10–36 V DC, leakage current < 0.6 mA. Temperature range: -20° to +80 °C / -4° to +176 °F. Not applicable to 6. sign "X", "Z1", "Z2", "Z3", "U1", "U2" and "E4".</p> |
| <p>Mechanical micro switches, 2 pcs. IP66 / NEMA 4X enclosure. M20 x 1.5 conduit entry (2 pcs.). Option E2: 1/2 NPT conduit entry (2 pcs.).</p> | |
| K05 | <p>OMRON D2VW-5, 3 A - 250 V AC, 0.4 A - 125 V DC, 5 A - 30 V DC. Temperature range: -40° to +80 °C / -40° to +176 °F. Not applicable to 6. sign "X", "Z1", "Z2", "Z3", "U1", "U2" and E4</p> |
| K06 | <p>OMRON D2VW-01, gold plated contacts, 100 mA - 30 V DC / 125 V AC. Temperature range: -40° to +80 °C / -40° to +176 °F. Not applicable to 6. sign "X", "Z1", "Z2", "Z3", "U1", "U2" and E4</p> |
| <p>Bus powered mechanical micro switches, 2 pcs. Applicable with ND9000F and ND9000P only. IP66 / NEMA 4X enclosure. M20 x 1.5 conduit entry (2 pcs.). Option E2: 1/2 NPT conduit entry (2 pcs.).</p> | |
| B06 | <p>OMRON D2VW-01, gold plated contacts; Bus Powered, no external power needed. Temperature range: -40° to +80 °C / -40° to +176 °F. Not applicable to 5. sign "H". Not applicable to 6. sign "U1", "U2" and "E4".</p> |

| 9. OPTIONS OF LIMIT SWITCH | |
|----------------------------|---|
| Y | <p>Special construction, to be specified.</p> |

ADDITIONAL ACCESORIES

| FILTER REGULATOR | |
|------------------|---|
| K | Filter regulator for supply air. Filter size 5 µm. Pressure gauge, scale bar/psi/kPa, basic material brass, nickel plated, housing stainless steel, glycerine filled. Temperature range -40 °C...+82 °C / -40 °F... +180 °F. K option includes a thread nipple 1/4"NPT to 1/4"NPT which is suitable with ND9200 & ND9300 positioner options A3 and A5 (1/4NPT AIR CONNECTION) |
| K1 | Filter regulator for supply air. Filter size 5 µm. Pressure gauge, scale bar/psi/kPa, basic material brass, nickel plated, housing stainless steel, glycerine filled. Temperature range -40 °C...+82 °C / -40 °F... +180 °F. K1 option includes a thread nipple 1/4"NPT to G1/4" which is suitable with ND9100 positioner and with option A1 (G1/4 AIR CONNECTION). |

| CONDUIT ENTRY NIPPLES | |
|-----------------------|--|
| CE07 | 1/2 NPT conduit entry nipples M20x1,5 / 1/2 NPT (ND9100) |
| CE08 | R1/2 (PF1/2) conduit entry nipples M20x1,5 / R1/2 (ND9100) |
| CE09 | 1/2 NPT conduit entry nipples Brass M20x1,5 / 1/2 NPT, Exd approved (ND9200) |
| CE19 | 1/2 NPT conduit entry nipples Stainless Steel M20x1.5 / 1/2 NPT, Exd approved (ND 9300) |

| CABLE GLANDS | |
|--------------|--|
| | Not to be used together with conduit entry nipples (CE_) or connection plugs (P_). |
| CG5 | M20x1.5 grey/plastic, IP66 |
| CG6 | M20x1.5 blue/plastic, IP66, Ex e |
| CG42 | G 1/2 Conduit entry and Cable entry adapter, JIS approved (ND9200H) |
| CG41 | 1/2 NPT Conduit entry and Cable entry adapter, JIS approved (ND9200H) |

| PRESSURE GAUGES AND CONNECTION BLOCKS | |
|---------------------------------------|---|
| A1 | Pressure gauges, scale bar/psi/kPa, basic material brass, housing nickel plated stainless steel, glycerine filled. Connections G1/4 (S, C1, C2). Temperature range -40 °C...+85 °C / -40 °C...+185 °F. |
| A3 | Pressure gauges, scale bar/psi/kPa, basic material brass, housing nickel plated stainless steel, glycerine filled. Connections 1/4 NPT (S, C1, C2). Temperature range -40 °C...+85 °C / -40 °C...+185 °F. |
| A5 | Pneumatic connection block. Material AISiMg, anodized grey. Connections 1/4 NPT (S, C1, C2). Temperature range -40 °C...+85 °C / -40 °C...+185 °F. Only for ND9100. |
| A6 | Pressure gauges with connections G1/4. Material AISI 316. Only for ND9300 |
| A7 | Pressure gauges with connections 1/4 NPT. Material AISI 316. Only for ND9300 |

| CONNECTION PLUGS | |
|------------------|---|
| | Not to be used together with conduit entry nipples (CE_) or cableglands (CG_). |
| P1H | ND9100H (HART): Connection plug according to M20x1.5 / DIN 43650A (ISO 4400). Not applicable with 5.sign "F" and "P". |
| P4H | Valve controller and limit switch with connection plugs (1 + 1 pc) ND9100H (HART): M20x1.5 / DIN 43650A (ISO 4400). ND9100/K00 or 2 wire ND9100/I00. Not applicable with 5.sign "F" and "P". |
| P2F | ND9100F and ND9100F/B06 (FOUNDATION fieldbus): Connection plug male eurofast, Turck FSV49, M20x1.5 / M12. Not applicable with 5.sign "H" and "P". |
| P3F | ND9100F and ND9100F/B06 (FOUNDATION fieldbus): Connection plug male minifast, Turck RSFV49, M20x1.5 / 7/8". Not applicable with 5.sign "H" and "P". |
| P2P | ND9100P and ND9100P/B06 (Profibus PA): Connection plug male, Weidmuller 842593, M20x1.5 / M12. Not applicable with 5.sign "H" and "F". |
| P3P | ND9100P and ND9100P/B06 (Profibus PA): Connection plug male minifast, Turck RSFV48, M20x1.5 / 7/8". Not applicable with 5.sign "H" and "F". |

Subject to change without prior notice.

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